Med.Pix

Hold it! Correct use of inhalers in children with asthma

see also p 325

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You may recognize the following photograph as one recently published in *wjm* as part of an article on drug therapies for children with asthma.[1] The photograph was captioned, ". . . a young girl shows her inhaler technique to Olympic medallist Jackie Joyner-Kersee" (figure 1).

QUESTION: What is the medical error in this picture? What complications could arise?

John Harrington, HO/AP

In an article in a previous issue of *wjm,* a young girl shows her inhaler technique to Olympic medallist Jackie Joyner-Kersee

ANSWER:

The medical error

The inhaler technique shown in the photograph provides suboptimal aerosol delivery to the lower respiratory tract and deposits a large amount of medication in the oropharynx. A holding chamber or "spacer" would have improved drug delivery and reduced side effects of the medication.

Spacers are accessory devices that permit inhaler use in a patient who has difficulty with hand-mouth coordination, and they enhance the efficacy and efficiency of drug delivery to the lungs. Because children often are unable to time their inhalation with the activation of the inhaler, many experts recommend that children routinely use spacer devices with a metered-dose inhaler.[2]

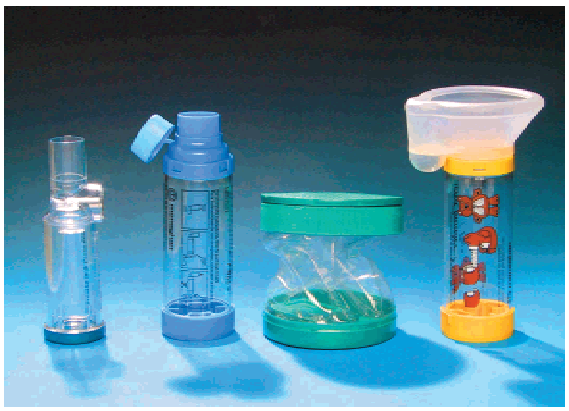
The metered-dose inhaler is engineered to deliver aerosolized medication to the respiratory tract. The subject drug is dissolved or suspended in propellants and miscellaneous dispersal agents. Through continued evaporation of the propellants, the medication is aerosolized into variably sized particles. The size distribution of these particles is the primary factor influencing the distribution of the drug. Inhalers that are able to generate a greater proportion of smaller particles are generally more effective in delivering medication to the smaller lower airways of a child.[3] The propellants used in these inhalers have historically been chlorofluorocarbons (also known as CFCs or freons), which have been proven to cause environmental damage by depleting ozone. Several inhalers now contain

hydrofluoroalkane, which is safer to the environment than CFCs and which may provide a greater percentage of smaller aerosolized particles.[4]

Metered-dose inhalers contain components that are pressurized. When activated, a liquid spray is ejected from the inhaler at about 15 meters per second. Therefore, when a patient uses the "closed-mouth" technique, as demonstrated by our young model, a high-velocity jet propels onto her oropharynx, and approximately 80% of the dose deposits locally.[5(pp409-417)] Some practitioners have advocated holding the inhaler's mouthpiece 4 cm from a wide-open mouth to increase the chance that particles could decelerate enough to be entrained into a low-flow inspiration. However, this technique requires synchronization of the inhaler's activation with inhalation, which children with asthma are seldom able to perfect. Many of the commercially available holding chambers are designed with valves that eliminate the need for synchronization. At the same time, spacers notably decrease oropharyngeal deposition of the medication by reducing aerosol velocity and by capturing larger, nonrespirable particles on the walls or valves of the device. The selective removal of these nonrespirable particles improves the safety of drug delivery because the local deposition of medication may lead to several adverse effects.

The complications that could arise

The most common adverse effects of an inhaler used without a spacer are candidiasis and dysphonia, which result from the local deposition of inhaled corticosteroids in the oropharynx. The high oropharyngeal deposition of these steroids also results in increased systemic absorption of the medication. This may cause adverse effects, such as a heightened risk for growth suppression and osteoporosis. The increased toxicity seen with direct inhaler use is not limited to inhaled steroids but is seen with other medications as well. Using an inhaler containing a β-agonist medication such as albuterol may result in significant tachycardia, irritability, or tremor.



Jeff Cutting

Spacer devices are available in a variety of sizes and styles

In addition, inhaler use without a spacer may cause patients themselves to have difficulties in adhering to the medication. Many patients are susceptible to the "cold-freon" effect, in which they are unable to complete the full inhalation because of the cold, uncomfortable feeling at the back of the throat. This feeling may result in premature cessation of inhalation, reflex cough, and bronchospasm. Other patients may not adhere to the treatment regimen because of the foul taste of inhaled medications. By removing the larger particles, spacers moderate the "flavor" of many inhalers and thus help to improve adherence.

CONCLUSIONS

The convenience, affordability, and efficiency of metered-dose inhalers have helped them become a favored form of drug delivery in asthma therapy. However, the operator requirements of hand-mouth coordination and the large amount of oropharyngeal drug deposition remain problematic, especially in children, who are less technically proficient than adults.[6] The use of a properly chosen holding chamber may enhance the delivery and distribution of the inhaled medications. The asthma expert panel established by the National Institutes of Health and the Cochrane Database of Systematic Reviews both recognize that the administration of a β-agonist by metered-dose inhaler and spacer is as effective as the gold standard of wet nebulization.[7,8] Several commercial spacer devices are available (figure 2). Most require patients to breathe in slowly from a mouthpiece and hold their breath. Younger children unable to use a mouthpiece or hold their breath may use a spacer with a face mask that delivers the dose over about 5 tidal breaths. Children and adolescents should be encouraged to use a spacer with all metered-dose inhaler medications. Prescribing suitable inhaled asthma therapeutics is futile if the medications do not reach their targets.

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